

SIXPENCE

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REMOTE CONTROLLED PRE - AMPLIFIER.

.. By Chas. Quin, VK5WQ ..

They say that Necessity is the Mother of Invention - well here is an example.

PLACE. A hams home with a 57-2A5 B.C.L. in the kitchen, joined, per medium of Antenna, to the shack, about $\frac{1}{2}$ wave length distant. Here a 6D6 6C6, 76, 42. T.R.F. is used as a Short Wave Set, or in this case, a preamplifier. A mike switched into the Detector circuit providing the necessary audio pickup.

TIME. During meals, or while the YF is washing up, and OM is reading the daily paper with his feet up on the gas stove.

NECESSITY. Junior op in the front bedroom (adjoining the shack), transmitting to the world in general that he is awake. To be certain of this, and not wanting to put his paper down, the OM thought and thought ----- RESULT.

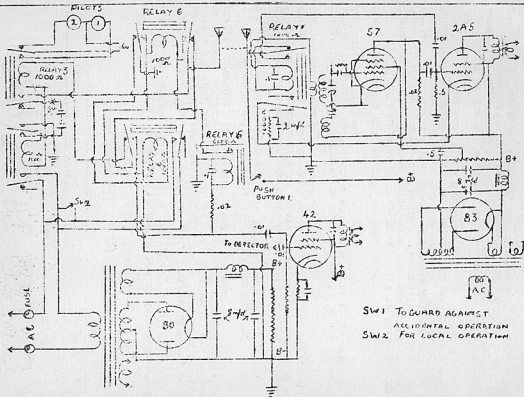
INVENTION ????? See diagram 1. - but don't be disheartened - its quite simple to operate - all you have to do is get somebody to press the button.

OPERATION OF THE UNIT IS THEN AS FOLLOWS:-

B.C.L. of course is in operation and YF is listening to her favorite serial. Strange sounds come from the front of the house - those sounds NOT associated to DX and certainly not CQ. Button pressed is number 1 - this places 250 volts between Antenna and ground. Relays 1, 2 and 3 operate and hold in. No. 1 holds in because its winding has the same resistance as the bias resistor of the 2A5, and Nos. 2 and 3 hold in by means of the local battery at the shack.

No. 1 at the BCL switches Antenna or line from tuning coil to Grid of 2 A5, through a condenser - this to isolate any high voltage from the grid - it also switches Cathode of 2A5 from normal resistor to the Relay winding, and then current of 2A5 holds this relay in.

Nos. 2 and 3 at the shack operate as follows - No. 2 switches local battery, also AC to power supply to TRF, No.3 switches local battery also, and when AC comes on, one Pilot Lamp.



This is the first half of the operations and BCL is still in normal operation with the exception that the grid of the 2A5 is switched to line.

When rectifier of TRF power supply has warmed up, current flows through choke, Voltage divider and Relay 4's windings. This Relay operates and holds in, performing the following switching actions. Antenna or line is switched to grid of 42 through a condenser, at the same time opening the battery return for Relays 2 and 3 - these then drop out of circuit. AC is still switched to power supply by the remaining contacts on Relay 4. The second Pilot Lamp now lights through 3's contacts. TRF is then in normal operation with the exception that the grid of the 42 is switched to line.

Return circuit for Relay 1 is taken through Antenna coil of BCL to prevent any likelihood of "cross-talk" from broadcast stations.

RELEASE. To release the TRF from the BCL end, Button 1 is pressed again and held in for a few seconds to enable the apparatus at the shack to become disconnected as follows:-

250 volts is again applied between line and ground - this operates Relay 5 at shack, which places an Earth on Relay 6. Then relay 6, being in parallel with Relay 4, operates, and then 4 and 5 drop out of circuit - this because No. 4's earth return is opened by No. 6's contacts, and No. 5's line side is opened by No. 4 dropping out of the circuit.

Relay 6 is held for so long as Button 1 is pressed, thus preventing 2 and 3 making contact and thus repeating the primary cycle of operations. Increased load of Relay 6 on BCL power Supply reduces EMF and likewise Current of 2A5, therefore Relay 1 releases and BCL is then in normal operation. When Button 1 is released Relay 6 drops out of circuit and Relay 1 resumes its normal position.

REMARKS. Current taken is not excessive. For first pressure of button the current is only 25-30 Milliamps - this because the Relays operate immediately. For the Second pressure of the Button the Current is higher - 60 Milliamps - this because 1000 ohms is across line and ground. An 83 Rectifier is used at the BCL as this has higher current handling facilities than the 80.

Old type Telephone Relays were used, - these were of fairly low resistance (1000 ohms) and their contacts were only a pair of DPDT. With the exception of Relay switch which has a resistance of 6000 ohms. This is not a telephone type relay, but was taken from a Fultograph Machine.

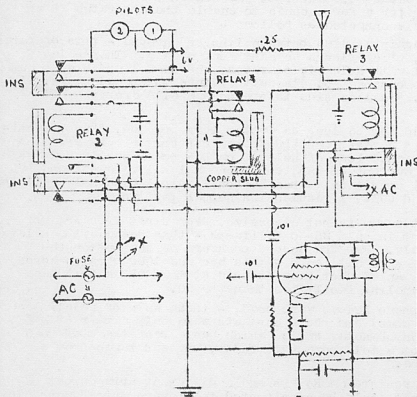
With higher resistance Relays and a different arrangement of contacts, this unit could be constructed to operate with fewer Relays. For example, one would still have to be used at the BCL end; and at the shack, one to operate and hold until the rectifier supplied current to operate a further relay, then a third to switch this off and still remain in circuit until all apparatus had been disconnected.

See diagram 2 for a suggested circuit .

The TRF also has an Antenna of its own, and this could be utilised to receive any Special programs the OM may want to listen to during Meals (with of course kind permission of the MF), when the Junior op is having his tea.

This unit has been in operation for over four months now, and the writer can vouch for its ability to operate as soon as tubes warm up, which is only a few seconds. It has a few advantages over other pre-amplifiers the writer has seen in the past, in that it does not consume current while not in the operating condition. Usually tubes were used and the unit just switched in when required.

Complete absence of hum is another feature. Even tried with a higher level hum was still conspicuous by its absence. If construction of this unit is contemplated, be very careful of insulation of all leads and connections before trial operation as 230 volts AC and 250 Volts DC are in close proximity. Use good quality condensers to isolate grids of audio tubes from line. Also Antenna connections should be good and well insulated from earth.



NOTE. Copper slug will retard action of Relay 4 for sufficient period so that Relay 2 will operate before Relay 4 breaks its circuit when first switched on.

THE ELECTRON MICROSCOPE.

... By W.J. McElrea VK2UV ...

Much of our present day knowledge would still be unknown if Science had not had that most important instrument, the microscope, to investigate details too small for the unaided eye to see and to discover minute organisms and fine structure in substances which had been quite unsuspected prior to its invention.

By the term microscope we mean an instrument by which we obtain an image of small objects and so any optical arrangement, even a single simple lens, which will give an enlarged image, whether real or virtual, of a small object, may be regarded as a microscope.

The term microscope, however, is usually applied to the compound microscope, which has a lens system consisting of an objective and an eyepiece, while a third lens called the condenser may be used to illuminate the object. In the modern optical microscope the useful magnification may extend to 3000 diameters, the limit being imposed by the wavelength of the light used for illumination, as we shall see later.

In the compound microscope the objective is the most important lens since its properties make or mar the final image to a much greater degree than do those of the eyepiece. Incidentally, although we refer to the objective as a lens, an objective of even medium power is invariably composed of two or more lenses, the number may go to six or even higher.

The main functions of an objective are -

1. To gather the light coming from any point of the object.
2. To unite this light into a point at the image.
3. To form the image at such a distance that magnification is obtained.

To examine the finer details of structure it is necessary that the light utilised shall come from the object examined in as wide a range of directions as possible, the Numerical Aperture (N.A.) of the lens depending on this angle and on the refractive index of the medium in which the object is immersed.

Now it may be thought that there is no limit to the amount of magnification of detail that can be obtained in a microscope, but unfortunately, after a certain degree in magnification is reached, further increase in magnification does not increase the amount of detail visible in the image and "empty" magnification which does not bring out additional minute structure is of little aid in the study of any object.

This loss of detail is due to diffraction taking place when light travels through the object - an image of a very fine slit, for example, would not appear as a slit but as a series of light and dark bands - and the greater the wavelength of the light and more objectionable is the effect of this diffraction.

Using an immersion objective with a N.A. of 1.52 (the maximum possible) the limit of resolving power in microns ($1 \text{ micron} = 10^{-4} \text{ cm}$) is 0.17 and thus the smallest object which can be resolved by the optical microscope in violet light is 0.17 microns in thickness.

A thinner line would not be shown as such but would still appear 0.17 microns thick. This distance is about one half of the wavelength of violet light (0.4 microns). For photographic work the limit of resolution in ultraviolet light is about 0.13 microns.

The optical ultramicroscope will reveal particles smaller than this in the same way that a beam of sunlight illuminates dust particles floating in a darkened room but the image seen does not necessarily duplicate the structure of the object.

Thus we can see that no matter what improvements are made in lenses no direct optical observation in visible light can clearly show any objects less than 0.17 microns in thickness.

The Electron Microscope. We have seen that the limitations of the optical microscope are due to the wavelength of the light used and not to inefficiency of modern lenses and hence microscopes have been developed which depend on electron streams and not upon light. Practically all of the theorems and corrections of geometric optics have been translated into their equivalents in electron optics and by means of magnetic and electric fields lenses have been calculated which will give the electron equivalent of an optical instrument such as the microscope.

According to de Broglie the wavelength associated with an electron having a speed corresponding to V volts is \sqrt{V} Angstrom units; thus the wavelength corresponding to an electron speed of 50,000 volts is 0.55×10^{-3} microns and so, taking the N.A. of the largest diameter magnetic coil which will produce a satisfactory image as 0.02 the resolution of the electron microscope can theoretically be 0.27×10^{-3} microns at 50,000 volts and 0.19×10^{-3} microns at 100,000 volts, thus giving a resolving power nearly 1000 times as fine as the optical microscope.

Every amateur who has used a cathode ray oscillograph knows that in it we have a stream of electrons produced by an "electron gun" which is caused to vary in direction by means of electric or magnetic fields. This stream of electrons strikes a fluorescent coating on the screen of the tube and then, and only then, shows its existence to us by causing this fluorescent coating to emit visible light.

Now in the cathode ray oscillograph we are interested in examining the voltages which are causing the deflection of the beam and for this observation the stream has to be focussed so that it meets the fluorescent coating in as small a spot as possible. This is achieved by varying the potentials of the anodes in the electron gun portion of the tube.

In the electron microscope we have a similar state of affairs in that a stream of electrons emitted from or passing through a given

object is passed through "electron lenses" in such a manner that when the stream meets the fluorescent coating at the base of the microscope all the electrons emitted from or passing through a given point in the object are caused to meet again at a point, thus giving an image of the object.

The focal lengths of the electron lenses of course are so chosen that this image is larger, and sometimes enormously larger, than the original.

Now the electron microscope at present is used in two ways -

1. To produce an image of the density of radiation of electrons from heated surfaces - i.e. various types of cathodes and alloys at elevated temperatures. A simple microscope, when used at powers of from 10 to 100 diameters is very useful to metallurgists, radio engineers and physicists in studying intimate details of electron emission.

2. For examination of fine detail in substances where the optical microscope has insufficient definition. Recent electron microscopes produce an image magnified about 30,000 diameters with such good definition that the definition is still good when enlarged by photographic means to 100,000 diameters. The main disadvantages of the electron microscope at present are -

1. The currents in each electron lens have to be very accurately controlled if blurred images are to be avoided.
2. The immense magnification makes the utmost rigidity necessary in the instrument and in the building housing it.
3. The instrument has to be compensated to account for the effect of the earth's magnetic field which will cause a considerable deflection of the beam.
4. Specimens under examination must be reduced into a high vacuum of the order of 10^{-5} mm. and there exposed to the electron beam. The high vacuum and electrical or thermal effects produced by the electrons may alter the specimen before or during examination.

Applications:-

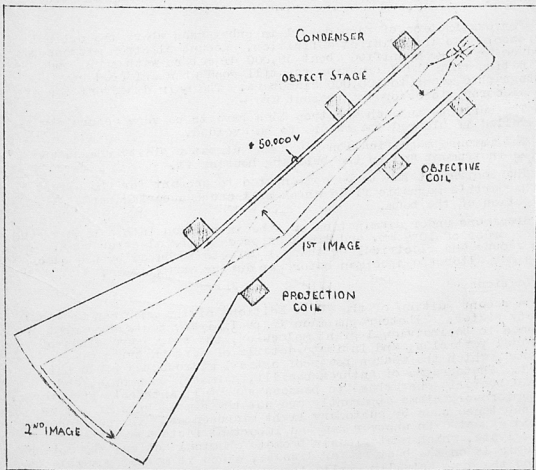
A recent edition of the "News Edition" of the American Chemical Society states: "Photographs made in preliminary tests show what are presumed to be individual giant molecules, the shapes and sizes of colloidal particles, and intimate details of certain types of bacteria, which the weaker power of optical microscopes could not reveal. Photographs of anthrax bacilli, germs of pneumonia, and typhoid bacteria show these to possess strangely intricate structures. These micro-organisms apparently are not the simple bits of jelly-like substance seen by customary light microscopes. The new instrument is expected to uncover now and important facts about the action of catalysts, which mysteriously promote chemical action; the action of chemicals on the bacteria of disease, since it may be possible to see how the drug actually kills the germ and the nature of synthetic resins and the processes by which they are formed."

Conclusion.

The electron microscope has now been developed far beyond the stage of a mere scientific experiment and can now be considered as a very important instrument for research. It represents a means of obtaining information which has previously been entirely beyond the means of direct observation.

Experiments are still being continued and it is hoped to eventually approach the ultimate resolving power of which the electron microscope is capable.

Reference. "Electron Optics" by L.M. Myers is a comprehensive work on the subject of electron lenses etc. and much of the material in this article was obtained from it. Any man wishing to learn some of the fundamental theory of electron lenses should consult this work - provided he is no more than a lap behind Einstein - the author of this article was left at the starting post.



SLOUCH HATS AND FORAGE CAPS.

... By VK2XC ...

Dear Oms,

You will never know what you missed. I'd had the old pon soaking in various kinds of vitriol in the dispensary - and I wasn't going to write about lack of notes, but along comes 3IR and the gang chock full of news, and all is forgiven. As I can't do better here's 3IR "verbatim."

" Ken Allon VK3UH recently returned from the Mod. got himself sunk in the Nestor, anyway Ken got off OK and it is whispered that many motors did not go down with the ship--hush! Ken says a bomb got tangled up with their di-pole and fell down the side of a ship. Anyway giving him a rest here and he has just bought a brand new P&G handbook to fool the RI's into believing he knows enough to accept the 2nd Class Commercial. By the way everyone here has gone all commercial nowadays. 3KQ (now up the tropics) and myself (3IR) both sat for the commercial ticket some months ago, neither of us has finished celebrating yet - strangely we both passed - most amazing!

Jack Coulter VK3MV - one of the Darwin boys, hasn't been home long. One of our receivers wanted re-lining tother day, so Jack brought down his box of tricks - a piece of apparatus which gained for him the name of "The Meanest man in Radio." Boy you should see it, its an oscillator come freq. meter, come sig generator, come Xtal set, come Monitor etc. It does everything but talk. Ask Jack what happened on his birthday - true he got amongst the hops and when he met his and 3KQ's XYL's he kissed the wrong one - must have been Sydney beer.

Talking of 3KQ (George Bonwell) he got a crash draft a few weeks ago to I thought I saw him running up and down the parade ground with his kit over his port shoulder practicing evacuation! If he can't work J dx via the ether he says he will get amongst it personally. Perhaps he may throw a few KW at them.

An amazing man called Stan Clarke-Troy of the Sir Kieth Murdoch Broadcasting network is an engineer of some repute in broadcasting circles and he devised a jar with two plates and a gallon of oil as a substitute for a condenser which departed this life here last night. Everyone is scared to go near it, primarily because it may blow up and secondly because if we move it an inch or so every marine operator is screaming at our frequency drift.

As for me, well I've been a bit ill lately - come call it a perpetual hangover, but the medical profession assert it is nerves.

Anyway had a good six weeks spell in hospital doing nil but am now back at the key again and soon be moving away for a bit. Was talking to VK5GP tother day - Graham Pitts by name - he is in the Marine Staff of AWA and is chief op on the lighthouse ship. Also saw Norm Gunter VK3NG also of AWA who continues to crawl around the coast as of yore -- 73 Harry White VK3IR."

From 2 ABM off the HMAS Cairns comes more news. He mentions meeting VK6FL and VK6AG and a couple of W's of the USN whose call signs he could not remember (what a man). He mentions a VK6 (Ted Potter) and a VK2 Jack Lumsdaine of the N.S.W. Police Force as being on the H.M.A.S. Toowoomba. However, the way chaps move around these days he says they may be anywhere at all by now.

Here in Sydney at the last WIA meeting we had quite a gathering, L/Tel Clark - who spins a pretty good yarn, W6PIZ off the Chicago and two very welcome VK3's, 3TE (Stan Dixon) and 30J (Stevens) who came in after attending lectures. Its really great to find chaps keen enough as hams - even after three years off the air - to find time after a lecture to look in at a WIA meeting in a strange city. By now they have probably moved on with their units, but we hope they make Sydney again soon. From our regular visitor VK3RJ we learned that Dad Britt 3HT and Bert Zender 3PG both with the Arm Divvy were well and fit and should be sampling pineapples off the bush by now. 3RJ also mentioned meeting Ron Hipwell and Gavin Douglas both of the R.A.A.F. in the harbour city, recently.

From Cpl. Sabin, R.A.A.F. Darwin comes news also of the ham spirit. Before the war he was a member of the Manly Radio Club and was sent up to N.W. Australia. Meeting there a chap from VK5 by name of Bob Fuller - they did some rag and at the local post-office sat and passed for the "ticket" so no time would be lost when it was time to call CQ again. Don't you reckon those two will make good hams--congratulations OMs - very FB indeed.

News comes to hand that Charlie Miller VK2ADE/4US is back in VK2 at last after nearly 3 years over the other side with the Sunderlands. Next month I hope to tell you more of what he and his cobbars have done over there. But consider their operational flying hours -- Norm McLeod 2PM 1700 hours, 2ADE 1200 hours, Frank Dehorty 3XE 1100. And don't forget the operations were NOT flying up and down VK!

73 and more news chaps for next month to VK2VC, 78 Maloney Street, Eastlakes, N.S.W.

D I V I S I O N A L N O T E S .

.. Federal Headquarters ..

...

Despite the fact that the September Meeting of the Federal Executive marked the third anniversary of the ban on transmissions by Experimenters the volume of business transacted was unduly large.

The main topic of discussion was the action of the Chief Radio Inspector, acting under instructions from Security Service, in directing that wireless transmitting apparatus belonging to amateurs should be taken into official custody for the duration of the war. Immediately Federal Headquarters were informed of this order a lettergram was sent to the Chief Radio Inspector asking for an extension of time for the lodgement of containers belonging to amateurs who were not satisfied that the components were securely packed. In addition assistance was asked for in the case of those Experimenters whose gear was packed in bulky containers. All requests made to the Department by F.H.Q. were granted by the Chief Radio Inspector.

Some little time ago Federal Headquarters asked the Department for a ruling regarding that clause of the Australian Broadcasting Act that stipulated that an additional fee of ten shillings was to be paid for every receiver after the first in any persons possession. The majority of Experimenters have built up quite a number of receivers of various types for operation in various parts of the spectrum allotted to amateurs and F.H.Q. were of the opinion that some injustices would be caused if amateur receivers were to be placed in this category. A reply has been received from the Department which in the opinion of F.H.Q. is rather ambiguous and it has been decided to ask for a more definite statement of the position.

A communication has now been received from the VK5 with a request that Federal Headquarters take over the affairs of this Division and enrol its members in the new body to be formed and known as the Wireless Institute of Australia whose office-bearers will be members of the Federal Executive.

The VK6 Division reports progress in its efforts to obtain permission for the inauguration of an Emergency Communication Network similar to that of the New South Wales Division.

A very generous donation has been received from Mrs. A. Campbell, mother of "Snow" towards the Prisoner's of War Fund and Federal Headquarters take this opportunity of publicly thanking her.

THE EMERGENCY COMMUNICATION NETWORK

Considerable progress has been made during the past month and it is anticipated that the Control Station will be heard testing very soon.

The construction of the racks and chassis is now completed and every station received its quota of equipment. Circuit diagrams have been posted to the amateurs concerned in the construction of the various stations whilst applications for the release of equipment to approved personnel have been forwarded on to the necessary authorities.

The recent custody order raised doubts in the minds of many amateurs as to how the Emergency Communication Network would be effected but fortunately any misgivings were quickly dispelled.

Unfortunately for reasons of Security it is impossible to give a list of the stations that will be operating and the personnel that will be attached to each, but it may be said that those amateurs who have been enrolled represent a cross section of Australian Experimenters. The Dx hound, 5 metre enthusiast, 40 metre "ragchewer", "one band hams" low power birds and high power merchants are all banded together with one object in mind, Service to the Community. Every member of the E.C.N. realises that the Network will not be an opportunity for a glorious ragchew - the mistake made by some reckless amateurs in the States, and that the future of amateur radio in Australia rests to a large degree in his keeping. He is determined that no action of his will bring discredit upon the Australian Experimenter and knows that the boys "up there" look to him to keep the flag flying and the bands wide open for the time when "73's om" will once more girdle the world.

--oOo--

NEW SOUTH WALES DIVISION

The attendance at the September Meeting of the Division reflected the re-awakened interest in ham radio that has been brought about by the formation of the Emergency Communication Network in this State. Quite a number of old faces were seen again whilst several newcomers made their presence felt.

Naturally the main topic was the recent instruction issued by the Radio Inspector's Department regarding the custody of sealed containers and Federal Headquarters and the State Council were complimented upon the prompt action that was taken in this matter. Members were informed of the assistance rendered by the Senior Radio Inspector in an endeavor to facilitate the smooth working of this regulation.

Several vacancies existing upon the State Council have now been filled by the election of Messrs. A.V. Bennet VK2VA, P. Dickson VK2AFB and R. Smith VK2AIU. Messrs. Dickson and Smith are newcomers whilst Mr. Bennett served for a time on the Council several years ago. These three new members of Council are keen hams and the Division should benefit by their election.

It was decided that the October General Meeting be given over to a Picture Night in aid of the VK2 Prisoner's of War Fund. This was made possible by the generosity of Mr. Vince Bennett VK2VA who has promised to make available projector and films for the night. The star attraction will be? I'd like to tell you but ---. This function, that will take place on 15th October, will not be confined to members only. You are asked to bring another ham, the YL,XYL or OW. Remember, the greater the number present the more parcels for P.O.W's.

A very interesting talk on "How to Run a Kilowatt on a Single 35T" was ably delivered by an American visitor Dave Hardaker, W6PIZ. This was much appreciated by Members including two other visitors, 30J and 3TE. Dave joined the Navy "to see the world" but saw more than he bargained for up and around VR4!

Another very illuminating talk was given by Perce Dickson VK2AFB on some very interesting foreign valves that had been "picked up" in Libya.

No don't forget chaps October 15th is Picture Night for the P.O.W. and bring a friend or two.

-----XXXXXXXX-----

VICTORIAN DIVISION

There was a good attendance at the last meeting of the Victorian Division, several visitors being present.

Among the visitors were VK4AW, VK4WJ, and VK6AF.

Keith Hatch, one of the Division's members who was on the H.M.A.S. Canberra when she was sunk, was also present, and gave a short talk on his adventures. He still wonders why Tulagi remains above the sea level, considering the amount of metal which landed on the island.

VK3IR who was on the Nestor when she was sunk in the "MED" was also present, but he could not be persuaded to talk.

VK4AW has been playing a little golf and succeeded in placing a ball in the Albert Park Lake, which according to VK4WJ is a little tough considering the fact the golf balls are getting very hard to get.. VK4AW congratulated the Division on the attendance at the meetings, he hadn't expected to see so many present.

The Prisoner's of War Fund is coming along fine. At the last meeting 12/- was collected, and we acknowledge since a donation from one of our members of £1/1/-. Together with 14/- collected at this meeting, there is a total of £2/7/-. Anyone wishing to contribute to the Fund can do so by forwarding their contribution to the Treasurer.

3RQ.. Flight Sgnt. Morry Quick was present at the meeting and expects to go interstate very shortly.

3RZ.. has had an attack of the common complaint--measles. Now sports three stripes.. just for being in hospital.

3OF.. is now in one of the navy depots in Victoria.

3VH.. is well in the tropics..spending some of his spare time swimming. Someone shot a 12 foot "croc" where he was in the water.

3ML.. is still in the North East Area, and is now a Wing Commander.

3UK.. is also a wing Commander and is Director of Signals. Nice going Vaughan.

3NY.. is spending a few weeks in the country relieving in the bank. Just wait till he sees this magazine???

3EF.. Is now attached to an R.A.A.F. Armament School.

3EK.. Corp. R. J. Bell R.A.A.F. is at present in ward 7A Heidelberg AGH.

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The Division meets on the Third Thursday of each month at Y.M.C.A. Buildings, Pitt Street, Sydney, and an invitation is accorded to all Amateurs to be present.

H A M S !

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